

TITLE OF THE INVENTION

RESERVOIR THAT A BRACKET IS INTEGRATED WITH

INCORPORATION BY REFERENCE

5 The present application claims priority under 35 U.S.C. §119 to Japanese Patent Application No. 2003-65923, filed on March 12, 2003. The contents of that application are incorporated herein by reference in their entirety.

BACKGROUND OF THE INVENTION

10 1. Field of the Invention

 This invention relates to a reservoir that a bracket is integrated with, more particularly to a reservoir that is installed into engine compartments of vehicles.

2. Discussion of the background

 Japanese Utility-Model Publication No. 6-16172 discloses a reservoir to reserve
15 various oil such as power steering oil for vehicles. Although this reservoir comprises a tank made of synthetic resin and a bracket made of metal to attach the tank with a body of the vehicle, a reservoir in which a tank and a bracket are integrally molded of synthetic resin is known.

 Meanwhile, Japanese Laid-Open Patent Application No. 8-258668 discloses a
20 method for protecting a pedestrian who is hit by a vehicle. The pedestrian is thrown up by a front bumper of the vehicle and received by an engine hood according to the method. Then, shock of the pedestrian collided to the engine hood is relieved by deformation of the engine hood. That is, the engine hood is deformed downwardly by collision of the pedestrian, and functions as a shock absorber. Generally, a reservoir is arranged upward
25 into an engine compartment, because of easy access for oil maintenance, and is rigidly

fixed to a body of the vehicle. Therefore, the deformed engine hood collides with the reservoir, and further deformation of the engine hood is prevented by the reservoir. This means that ability of the engine hood as the shock absorber for the pedestrian is deteriorated.

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SUMMARY OF THE INVENTION

In view of the foregoing, it is an object of the present invention to provide improved reservoirs. In order to achieve the above and other objects, a first aspect of the present invention provides a reservoir to reserve fluid for a vehicle. The reservoir comprises a tank reserving the fluid, a bracket integrated with the tank to install the tank in the vehicle, and an attaching portion arranged with the bracket. The attaching portion is configured so that the tank can be moved for the vehicle to absorb force that acts to the tank when the tank receives force larger than a predetermined value.

A second aspect of the present invention provides another reservoir to reserve fluid for a vehicle. The reservoir comprises a tank reserving the fluid, a bracket integrated with the tank to install the tank in the vehicle, an attaching portion arranged with the bracket to be fixed to the vehicle, and a connecting portion arranged with the bracket to connect the attaching portion to the tank. The connecting portion is configured so that the tank can be moved for the vehicle to absorb force that acts to the tank when the tank receives force larger than a predetermined value.

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BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and many of the attendant advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description of the preferred embodiments when

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considered in connection with the accompanying drawings, in which:

Fig. 1 is a side view of a reservoir according to a first embodiment of the present invention;

Fig. 2 is a plane view of the reservoir according to the first embodiment;

Fig. 3 is an enlarged cross-sectional view of a second attaching portion of the reservoir according to the first embodiment;

Fig. 4 is a front view of the reservoir to show forces acting to the reservoir; and

Fig. 5 is an enlarged partial view showing a second attaching portion of a reservoir according to a second embodiment of the present embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[First Embodiment]

A reservoir as a first embodiment of the present invention will be described with reference to Figs. 1-4. The reservoir that is arranged at upper place into an engine compartment of a vehicle as one of components of a power steering apparatus mainly comprises a tank 1 and a first and a second brackets 2, 4. Oil for the power steering apparatus is reserved into the tank 1. The reservoir is fixed to a body of the vehicle in the engine compartment by the brackets 2, 4 and bolts 9 as fixtures. Material of the tank 1 and brackets 2, 4 is synthetic resin, and the brackets 2, 4 are integrally molded with the tank 1.

The first bracket 2 is horizontally formed on an upper portion of the tank 1. The first bracket 2 comprises a first attaching portion 29 and a first connecting portion 25 that connects the tank 1 to the first attaching portion 29. A through hole 219 in which the bolt 9 is inserted is formed in the center of the first attaching portion 29. Plural arc-shaped concavities (four in this embodiment) 221 are formed on the first attaching portion 29

around the through hole 219 concentrically. As the result, a boss portion 21 around the through hole 29, a flange portion 23 located at the outside of the arc-shaped concavities 221 and rib portions 24 connecting the flange portion 23 to the boss portion 21 are formed on the attaching portion 29. The flange portion 23 is continued to the tank 1 along both edges of the first connecting portion 25 and the middle of them. The first connecting portion 25 is separated by the continued flange portions and ribs connecting them so that plural concavities (six in this embodiment) are formed on the first connecting portion 25. The above-described first bracket 2 functions as a shock absorber for force acting on the reservoir. That is, when the tank 1 receives excessive force (larger than a predetermined value) of its side direction, plastic deformation furthermore subsidiary fracture occur at the rib portions 24 and plane portions 22 that are thin bottoms of the arc-shaped concavities 221, which are located between the flange portion 23 and the boss portion 21. The excessive force that the tank 1 receives is absorbed by the plastic deformation or the subsidiary fracture of the rib portions 24 and the thin plane portions 22.

Meanwhile, as showing by Fig. 1, a notch 3 is formed at a middle of the first connecting portion 25. That is, section modules of the connecting portion 25 in its side view (the longitudinal direction) are decreased at the portion where the notch 3 is formed. Longitudinal location of a vertex of the notch 3 accords with the location of one of the ribs defining the concavities on the first connecting portion 25. Therefore, according to the first bracket 2, the first connecting portion 25 functions as a shock absorber for force of a direction that is parallel to the line O_1-O_1 . That is, when the tank 1 receives excessive force (larger than a predetermined vale) of its ups and downs direction, plastic deformation furthermore subsidiary fracture occur at notch 3 of the first connecting portion 25. The excessive force that the tank 1 receives is absorbed by the plastic deformation or the subsidiary fracture at the notch 3 of the first connecting portion 25. Further, because the

section modules of the connecting portion 25 are small at the notch 3, stress concentration occurs at the notch 3 rather than a root 27 of the first connecting portion 25. Therefore, not the root 27 but the notch 4 of the first connecting portion is fractured by the excessive force. If the connecting portion 25 is fractured at the root 27, the tank 1 also may be broken up. Breakage of the tank 1 causes of oil leak. However, according to the above-described first bracket 2, the connecting portion 25 is not fractured at the root 27. Therefore, oil leak is prevented, even if the tank 1 received the excessive force.

Similarly, the second bracket 4 is vertically formed on a middle in the vertical direction and a side in the horizontal direction of the tank 1. The second bracket 4 comprises an second attaching portion 49 and a second connecting portion 45 that connects the tank 1 to the attaching portion 49. A through hole 419 in which the bolt 9 is inserted is formed in the center of the second attaching portion 49. Plural arc-shaped concavities (four in this embodiment) 421 are formed on the second attaching portion 49 around the through hole 419 concentrically. As the result, a boss portion 41 around the through hole 419, a flange portion 43 located at the outside of the arc-shaped concavities 421 and rib portions 44 connecting the flange portion 43 to the boss portion 41 are formed on the second attaching portion 49. The flange portion 43 is continued to the tank 1 along both edges of the connecting portion 45. The above-described second bracket 4 functions as a shock absorber for force acting on the reservoir. That is, when the tank 1 receives excessive force (larger than a predetermined value) of its side direction, plastic deformation, furthermore subsidiary fracture occur at the rib portions 44 and plane portions 42 that are thin bottoms of the arc-shaped concavities 421, which are located between the flange portion 43 and the boss portion 41. The excessive force that the tank 1 received is absorbed by the plastic deformation or the subsidiary fracture of the rib portions 44 and the thin plane portion 42.

With reference to Fig. 4, when an engine hood is downwardly deformed by receiving a pedestrian who is thrown by a front bumper of a vehicle, impact strength that makes the engine hood be further deformed acts to the tank 1 as shown by an arrow P. Then, force as shown by an arrow F acts at the second attaching portion 49. This F direction force causes the plastic deformation or the subsidiary fracture of the rib portions 44 and the thin plane portions 42 because the tank 1 is turned around the line $O_2 - O_2$ as shown an arrow T1 by the plastic deformation or the subsidiary fracture of the notch 3. As the result, the flange portion 43 which is connected with the tank 1 and the boss portion 41 which is fixed by the bolt 9 become to be able to move relatively in order to absorb force acting on the reservoir. Further more, the P direction force causes the plastic deformation or the subsidiary fracture of the rib portions 24 and the thin plane portions 22 because the tank 1 is inclined in the direction as shown by an arrow T2. As the result, the flange portion 23 which is connected with the tank 1 and the boss portion 21 which is fixed by the bolt 9 become to be able to move relatively in order to absorb force acting on the reservoir.

According to the above-described reservoir, since the impact strength acting to the tank 1 is absorbed by the plastic deformation and subsidiary fracture of the first and/or the second brackets 2,4, damage that the pedestrian who is thrown up the engine hood of the vehicle receives is reduced. Further, since the tank 1 can be turned because of the plastic deformation and subsidiary fracture of the first and/or the second brackets 2, 4, further deformation of the engine hood is not prevented by the tank 1. Namely, the tank 1 not only has shock-absorbing function itself and but also does not prevent shock-absorbing function of the engine hood. Therefore, the pedestrian who is hit by the vehicle and thrown up on the engine hood can be protected.

[Second Embodiment]

A reservoir as a second embodiment of the present invention will be described with reference to Fig. 5. Because only the second bracket 4 of the first embodiment is different with the same of the second embodiment, a second bracket 5 of the second
5 embodiment will be described and description for others will be omitted. The second bracket 5 is vertically formed on middle in the vertical direction and side in the horizontal direction of the tank 1. The second bracket 5 comprises a second attaching portion 59 and a second connecting portion 55 that connects the tank 1 to the second attaching portion 59. A through hole 519 in which the bolt 9 is inserted together with a collar 91 is formed in the
10 center of the second attaching portion 59. Plural arc-shaped concavities (two in this embodiment) 521 are formed on the second attaching portion 59 around the through hole 519 concentrically. As the result, a boss portion 51 around the through hole 519, a flange portion 53 located at the out side of the arc-shaped concavities 521 and rib portions 54 connecting the flange portion 53 to the boss portion 51 are formed on the second attaching
15 portion 59. The flange portion 53 is continued to the tank 1 along both edges of the second connecting portion 45. A slit 6 that is continued to the through hole 59 is upwardly formed at the second attaching portion 59. A width of the slit 6 is defined to be slightly narrower than the diameter of the collar 91. The above-described second bracket
5 functions as a shock absorber for impact strength shown by the arrow P. That is, when
20 the tank 1 receives excessive force (larger than a predetermined value) of its ups and downs direction, the bolt 9 and the collar 91 are detached from the through hole 519. Then, the second attaching portion 59 is deformed to be widened so that the collar 91 goes through, and the collar 91 slides on the slit 6. Therefore, the impact strength that the tank 1 receives is absorbed by the deformation of the attaching portion 59 and the friction
25 between the collar 91 and walls defining the slit 6. Further, because the bolt 9 is detached

from the through hole 519, the tank 1 becomes being able to be turned. Therefore, further deformation of the engine hood is not prevented by the tank 1.

Although both of the first and the second brackets 2, 4 that function as the shock absorber are used according to the first and the second embodiments, it is possible that only one of the first and second brackets 2, 4 is used. Further, it is possible that one of the first and the second brackets 2, 4 that functions as the shock absorber and another bracket that does not function as such shock absorber are used. Furthermore, although both of the attaching portion 29 and the connecting portion 25 of the first bracket 2 function as the shock absorber, it is possible that a bracket that functions as the shock absorber at only one of the attaching portion and connecting portion is used.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is thereby to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.